

**AMENDMENT AND RESPONSE UNDER 37 CFR § 1.111**

Serial Number: 09/858,238

Filing Date: May 15, 2001

Title: ELECTRONIC PACKAGE WITH HIGH DENSITY INTERCONNECT AND ASSOCIATED METHODS

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45. (New) The method recited in claim 44, wherein the plurality of vertical stack patterns each comprise at least three lands, and wherein the traces coupled to corresponding lands in each vertical stack are all located on the same side of the vertical stack.

**REMARKS**

Applicants have carefully reviewed and considered the Office Action mailed on July 18, 2002, and the references cited therewith.

Claims ~~13-15~~ and ~~25-31~~ are canceled. Claims 1-3, 5-10, 16-17, 19-24, and 32-33 are amended. New claims 36-45 are added. As a result, claims 1-12, 16-24, and 32-45 are now pending in this application.

**Amendments to the Specification**

Applicants have made several amendments to the specification by substituting "embodiments of the invention" or "disclosure" for "invention". Applicants do not wish the claims to be interpreted as being limited to a single "invention". No new matter has been added by way of these amendments to the specification.

**Amendments to Claims 1-3, 5-10, 16-17, 19-24, and 32-33**

Each of original claims 1-3, 5-10, 16-17, 19-24, and 32-33 has been amended. No new matter has been introduced. The amendments to the claims are made to satisfy Applicants' preferences, not necessarily to satisfy any legal requirement(s) of the patent laws, and they are not intended to limit the scope of equivalents to which any claim element may be entitled.

Independent claim 1 now recites additional limitations that have been incorporated from original claim 6, because the Examiner indicated that original claim 6 would be allowable if rewritten in independent form.

In dependent claim 2, the language "maximum trace escape density" has been substituted for "density of the second dense formation of lands". Corresponding amendments have also been made to dependent claims 8, 20, 28, and 33. Support for these amendments may be found in

equation (1) and in the original written description on page 14, lines 15-21.

Dependent claim 3 now recites that the second dense formation of lands is formed in a pattern comprising a combination of a face center rectangular pattern and a zigzag pattern having a plurality of zigzag rows. Support for this amendment may be found on page 12, lines 10-16 of the original written description.

Dependent claim 5 now recites that the second dense formation of lands is formed in a pattern comprising a combination of a face center rectangular pattern and an undulating pattern. Support for this amendment may be found on page 12, lines 10-16 of the original written description.

Dependent claim 6 now recites that the second dense formation of lands is formed in a pattern comprising a combination of a face center rectangular pattern and a wave pattern. Support for this amendment may be found in FIG. 7 and on page 12, lines 10-16 of the original written description.

Independent claims 7 and 16 now recite a second dense formation of lands formed in an undulating pattern. Support may be found in FIG. 6 and on page 11, lines 5-19 of the original written description.

Dependent claims 9 and 17 now recite that the second dense formation of lands is formed as a plurality of undulating rows at the periphery of the surface of the substrate. Support may be found in FIG. 6 and on page 11, lines 5-19 of the original written description.

Dependent claim 10 now recites that the second dense formation of lands further comprises a face center rectangular pattern. Support may be found on page 12, lines 10-16 of the original written description.

Independent claim 19 now recites several additional limitations. The lands are recited as being formed within a die-bonding area on the substrate surface. The plurality of traces are recited as escaping the die-bonding area. The plurality of traces are additionally recited as being formed in at least one geometrical pattern that maximizes the trace escape density while constrained by the land size and by the width and spacing of the traces, wherein the at least one geometrical pattern comprises a vertical stack pattern having at least three or more lands in a vertical stack. Support may be found in FIG. 8 and in the accompanying written description

beginning on page 12, line 20.

Dependent claim 21 now recites that the plurality of lands are formed as a plurality of vertical stack patterns at the periphery of the surface of the substrate. Support may be found in FIG. 8 and in the accompanying written description beginning on page 12, line 20.

Dependent claim 22 now recites that the plurality of vertical stack patterns each comprise at least three lands, and wherein the substrate traces coupled to corresponding lands in each vertical stack are all located on the same side of the vertical stack. Support may be found in FIG. 8 and in the accompanying written description beginning on page 12, line 20.

Dependent claim 23 now recites that the at least one geometrical pattern further comprises an undulating pattern. Support may be found on page 12, lines 10-16 of the original written description.

Dependent claim 24 now recites that the at least one geometrical pattern further comprises a face center rectangular pattern. Support may be found on page 12, lines 10-16 of the original written description.

Independent claim 32 now recites several additional limitations. Lands are now recited as being formed within a die-bonding area on a substrate surface in a geometrical pattern to maximize the trace escape density of traces coupled to the lands and escaping the die-bonding area on the substrate surface while constrained by the land size and by the width and spacing of the traces, wherein the lands are formed in a vertical stack pattern having at least three or more lands in a vertical stack. Support may be found in FIG. 8 and in the accompanying written description beginning on page 12, line 20.

#### **New Claims 36-45**

New claims 35-45 have been added to provide Applicants with additional protection to which Applicants are entitled. No new matter has been introduced.

Independent claim 36 is directed to a substrate having a second dense formation of lands formed in an undulating pattern. Support may be found in FIG. 6 and on page 11, lines 5-19 of the original written description.

Dependent claim 37 is similar to original dependent claim 8, as amended.

Dependent claim 38 is similar to dependent claim 9, as amended.

Dependent claim 39 is similar to dependent claim 10, as amended.

Independent claim 40 is directed to a substrate having a second dense formation of lands formed in a vertical stack pattern. Support may be found in FIG. 8 and in the accompanying written description beginning on page 12, line 20.

Dependent claim 41 is similar to original dependent claim 8, as amended.

Dependent claim 42 is similar to original dependent claim 21, as amended.

Dependent claim 43 is similar to original dependent claim 24, as amended.

Dependent claim 44 is similar to original dependent claim 21, as amended.

Dependent claim 45 is similar to original dependent claim 22, as amended.

#### **Claim Objections**

Claims 13-15 were objected to because of a missing word ("at") in claim 13.

Applicants respectfully assert that the claim objections are moot and should be withdrawn, because claims 13-15 have been canceled.

#### **Rejections Under 35 U.S.C. § 112, First Paragraph**

Claims 2, 8, 20, 28, and 33 were rejected under 35 U.S.C. § 112, first paragraph, as containing subject matter that was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

The Examiner stated that while being enabling for determining the maximum trace escape density, the specification does not reasonably provide enablement for determining the maximum land density. As to enablement for determining *the* maximum land density, Applicants would probably agree with the Examiner. However, Applicants assert that the specification teaches various ways in which to substantially increase, or maximize, the density of lands on a die-bonding area, when such lands have traces coupled thereto that escape the die-bonding area.

The Examiner further stated that there is no support in the specification that the reciprocal

of ( $T_w + T_s$ ) determines the density of the lands as recited in claims 2, 8, 20, 28, and 33. Applicants agree with the Examiner on this point, and accordingly claims 2 and 8 have been amended by substituting "maximum trace escape density" for "density of the second dense formation of lands". Claims 20, 28, and 33 have been similarly amended.

Applicants respectfully request that the rejection of claims 2, 8, 20, 28, and 33 under 35 U.S.C. § 112, first paragraph, be withdrawn.

#### **Rejections Under 35 U.S.C. § 102(e)**

Claims 1-5, 19-23, and 25-33 were rejected under 35 U.S.C. § 102(e) as being anticipated by Horiuchi et al. Although the Examiner cited three Horiuchi patents on the PTO-892 form, presumably the Examiner is applying only the U.S. Pat. No. 6,407,344 of Horiuchi, because that is the only one of the three Horiuchi patents that contains formulae at lines 55 and 61 of column 5, as mentioned on page 3, paragraph 5, of the Examiner's Office Action. Applicants do not admit that Horiuchi is prior art and reserve the right to swear behind Horiuchi as provided for under 37 C.F.R. § 1.131.

Horiuchi discloses a multilayer circuit board to mount an electronic part on lands that are arranged in certain patterns to improve routing.

Independent claim 1, as amended, is asserted to distinguish over Horiuchi, because it now includes the limitations of dependent claim 6, which the Examiner indicated would be allowable if rewritten in independent form. Thus claim 1, and the claims dependent therefrom, should be held to be allowable, and Applicants respectfully request that the rejection of claims 1-5 as anticipated by Horiuchi under 35 U.S.C. § 102(e) be withdrawn.

Regarding independent claim 19, Horiuchi does not appear to disclose forming a plurality of lands in a die-bonding area of a substrate in at least one geometrical pattern that maximizes the trace escape density while constrained by the land size and by the width and spacing of the traces, wherein the at least one geometrical pattern comprises a vertical stack pattern having at least three or more lands in a vertical stack.

For the above reasons, claim 19 should be found to be allowable over Horiuchi, and Applicants respectfully request that the rejection of claim 19 under 35 U.S.C. § 102(e) as anticipated by Horiuchi be withdrawn.

Claims 20-24, which depend from claim 19 and incorporate all of the limitations therein, are also asserted to be allowable for the reasons presented above.

Claims 25-31 have been canceled.

Regarding independent claim 32, Horiuchi does not appear to disclose forming lands within a die-bonding area on a substrate surface in a geometrical pattern to maximize the trace escape density of traces coupled to the lands and escaping the die-bonding area on the substrate surface while constrained by the land size and by the width and spacing of the traces, wherein the lands are formed in a vertical stack pattern having at least three or more lands in a vertical stack.

For the above reasons, claim 32 should be found to be allowable over Horiuchi, and Applicants respectfully request that the rejection of claim 32 under 35 U.S.C. § 102(e) as anticipated by Horiuchi be withdrawn.

Claims 33, 44, and 45, which depend directly or indirectly from claim 32 and incorporate all of the limitations therein, are also asserted to be allowable for the reasons presented above.

#### **Rejections Under 35 U.S.C. § 103(a)**

Claims 7-15, 34, and 35 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Horiuchi et al. (presumably U.S. Pat. No. 6,407,344) in view of Akram et al. (U.S. Patent No. 6,313,522).

Horiuchi was discussed previously. Akram discloses the use of solder elements to connect lands of an integrated circuit (either a bare die or a packaged die) to corresponding lands of a substrate.

Regarding independent claim 7, neither Horiuchi nor Akram appear to disclose *inter alia* a second dense formation of lands formed in an undulating pattern. Applicants consider additional elements and limitations of claim 7 to further distinguish over the suggested combination of Horiuchi and Akram, and Applicants reserve the right to present arguments to

this effect at a later date.

For the above reasons, claim 7 should be found to be allowable over Horiuchi in view of Akram, and Applicants respectfully request that the rejection of claim 7 under 35 U.S.C. § 103(a) as being unpatentable over Horiuchi in view of Akram be withdrawn.

Claims 8-12, which depend from claim 7 and incorporate all of the limitations therein, are also asserted to be allowable for the reasons presented above.

Claims 16 and 17 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Horiuchi et al. (presumably U.S. Pat. No. 6,407,344) in view of Akram et al. (U.S. Patent No. 6,313,522) and Bothra et al. (U.S. Patent No. 6,327,695).

Horiuchi and Akram were discussed previously. Bothra discloses the use of an integrated circuit in a data processing system.

Regarding independent claim 16, Horiuchi, Akram, and Bothra, whether considered singly or in combination, do not appear to disclose *inter alia* a second dense formation of lands formed in an undulating pattern. Applicants consider additional elements and limitations of claim 16 to further distinguish over the suggested combination of Horiuchi, Akram, and Bothra, and Applicants reserve the right to present arguments to this effect at a later date.

For the above reasons, claim 16 should be found to be allowable over Horiuchi in view of Akram and Bothra, and Applicants respectfully request that the rejection of claim 16 under 35 U.S.C. § 103(a) as being unpatentable over Horiuchi in view of Akram and Bothra be withdrawn.

Claim 17, which depends from claim 16 and incorporates all of the limitations therein, is also asserted to be allowable for the reasons presented above.

Claim 18 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Horiuchi et al. (presumably U.S. Pat. No. 6,407,344) in view of Akram et al. (U.S. Patent No. 6,313,522) and Bothra et al. (U.S. Patent No. 6,327,695), as applied to claim 16 above, and further in view of Bertin et al. (U.S. Patent No. 6,243,283).

Horiuchi, Akram, and Bothra were discussed previously. Bertin discloses the packaging of an unpackaged processor die within a data processing system.

Regarding claim 18, Horiuchi, Akram, Bothra, and Bertin, whether considered singly or

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in combination, do not appear to disclose *inter alia* a second dense formation of lands formed in an undulating pattern, to which are coupled a first plurality of lands of an unpackaged die.

Applicants consider additional elements and limitations of claim 18 to further distinguish over the suggested combination of Horiuchi, Akram, Bothra, and Bertin, and Applicants reserve the right to present arguments to this effect at a later date.

For the above reasons, claim 18 should be found to be allowable over Horiuchi in view of Akram, Bothra, and Bertin. Applicants respectfully request that the rejection of claim 18 under 35 U.S.C. § 103(a) as being unpatentable over Horiuchi in view of Akram, Bothra, and Bertin be withdrawn.

**Allowable Subject Matter**

Claims 6 and 24 were objected to as being dependent upon a rejected base claim, but were indicated to be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. As indicated above, the limitations of claim 6 have been rewritten into independent claim 1. However, the limitations of claim 24 have not been rewritten into independent claim 19, because claim 19 is asserted to be patentable over Horiuchi for the reasons presented above.

**Conclusion**

Applicants respectfully submit that claims 1-12, 16-24, and 32-45 are in condition for allowance, and notification to that effect is earnestly requested. The Examiner is invited to telephone Applicants' attorney Walter W. Nielsen at 602/298-8920 or the below signed attorney to facilitate prosecution of this application.

If necessary, please charge any additional fees or credit overpayment to Deposit Account No. 19-0743.



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Respectfully submitted,

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**CERTIFICATE UNDER 37 CFR 1.8:** The undersigned hereby certifies that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail, in an envelope addressed to: Commissioner of Patents, Washington, D.C. 20231, on this 11 day of October, 2002.

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